

ENGLISH

Focus

Service Manual

51714-IMG rev. 2

Copyright

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**Manufactured by**

Instrumentarium Dental, PaloDEx Group Oy
Nahkelantie 160 (P.O. Box 20)
FI-04300 Tuusula
FINLAND
Tel. +358 10 270 2000
Fax. +358 9 851 4048

For service, contact your local distributor.

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1 Introduction

1.1 FOCUS™ intraoral X-ray unit

FOCUS™ is a micro processor controlled intraoral X-ray unit with a HF DC generator, which produces high quality dental images with film or digital receptors.

A well balanced support arm is easy to move and very stable, keeping the unit motionless during the exposure.

This manual supports two FOCUS™ intraoral X-ray major design revisions, namely version 2.0 and version 3.0. See the correct chapter of the manual for each revision in a case they differ. Note, that spare parts should also be ordered accordingly.

The correct design revision can be recognized from the serial number of the X-ray device as follows:

Version	serial number
FOCUS™ 2.0	5000 – 7999
FOCUS™ 3.0	8000 –

1.2 Scope

This document supplements User Manual and Installation manual for servicing the X-ray unit. This is not a stand-alone manual. Refer the Associated documentation to operate and to install the X-ray unit.

Only a trained and authorized service personnel are allowed to service the unit.

Disclaimer

Instrumentarium Dental endeavors to produce product documentation that is accurate and up to date. However, our policy of continual product development may result in changes to products that are not reflected in the product documentation. Therefore this document should be regarded as an infallible guide to current product specifications.

Instrumentarium Dental maintains the right to make changes and alterations without a prior notice.

1.3 Associated documentation

- 51774 FOCUS™ user manual (translations available)
- 51775 FOCUS™ Installation manual
- 208643 FOCUS™ Spare parts catalogue

1.4 Servicing warnings and precautions

General precautions

- The FOCUS™ intraoral x-ray unit must only be serviced and repaired by service personnel who have been trained and approved by Instrumentarium Dental. This manual is an aid to servicing the units and is NOT a substitute for approved Instrumentarium Dental service training.
- Before attempting to service a unit make sure that you know how to operate the FOCUS™. Read the FOCUS™ user's manual.
- Only use original Instrumentarium Dental spare parts when repairing the unit or replacing parts.

Radiation Safety

- Before servicing the unit familiarize yourself with local and national radiation safety standards and requirements relating to dental x-ray equipment.
- If you need to take test exposures you MUST take adequate steps to protect yourself from radiation. Use a lead apron or stand behind a suitable radiation shield.
- In addition, when taking exposures stand at least two meters (six feet) from the FOCUS™.

Mechanical safety

- Switch the power off and disconnect the unit from the main power supply before removing any covers. Disconnect the unit from the main power supply before repairing or replacing mechanical parts.
- Be careful when handling the unit not to get body parts or clothing trapped between the articulated arm.
- When replacing the tube head handle the articulated arm carefully as it will move suddenly when the tube head is removed.

Electrical Safety

- Switch the power off and disconnect the unit from the main power supply before replacing circuit boards or other electrical components. If there are capacitors on a circuit board or electrical component wait ten (10) minutes, after disconnecting the unit from the power supply, before handling the board or component.
- Live electrical terminals are potentially dangerous.
- Make sure that main power supply is OFF before removing covers or circuit boards.
- This equipment should be used only in areas that are provided with a protective earth connection to ensure an equipotential ground connection.
- Before cleaning or disinfecting the unit switch the main power supply off.

Electrostatic discharge

- Electrostatic Discharge (ESD) can damage or destroy electronic components.
- A static electricity charge builds up in everyone. The build up is due to movement, humidity, the person's clothing and the conductivity of the floor. If anyone charged with static electricity touches a electronic component the static electricity will discharge through the component and can damage or destroy it. Note that components damaged by electrostatic discharge can fail at a later date.
- When servicing the unit take proper precautions to avoid electrostatic build up and discharge (ESD).
- Follow the recommendations for the prevention of ESD that are used in the country in which you are working. If no recommendations are available follow the guide lines below.
- Before handling any electrical parts or components make sure that any static electricity charge that has built up in you body is discharged.
- When handling electrical parts or components use an elasticated wrist wrap which is connected to a ground point through a 1 Mohm current limiting cable. For a ground point use water pipes, radiators or other

objects that are known to be connected to the ground.

- Also use a cable to connect the unit to the same ground potential as the wrist wrap.
- If an antistatic mat is used, connect the wrist wrap to the carpet and the carpet to the ground potential.
- Wash the wrist wrap and check that it is good condition frequently.

Explosion Hazard

- Certain disinfectants and cleaning agents may vaporize to form an explosive vapour. If such chemicals are used the vapour should be allowed to disperse before switching the unit on.

Operating warnings and precautions

- The FOCUS™ intraoral x-ray must only be used to take intraoral exposures. It must not be used for any other purpose.
- The unit or its accessories must not be modified, altered or remanufactured in any way. Repairing shall be performed by Instrumentarium Dental authorized service only.
- As radiation safety and protection requirements vary from country to country and state to state it is the responsibility of the operator to ensure that all local and national radiation safety and protection requirements are met.
- The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:
 - use of the accessory in the PATIENT VICINITY
 - evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 601-1 or IEC 950 and/or IEC 601-1-1 harmonized national standard.

Unauthorized Modifications

- Unauthorized changes or modifications to any part of the unit or its equipment can have hazardous consequences.
- Changes or modifications must not be made unless specifically authorized by Instrumentarium Dental.
- When properly assembled with a compatible beamlimiting device, the diagnostic source assembly will fully meet the United States of America Federal Performance Standards for Diagnostic X-Ray Systems and their Components (21 CFR 1020 .30-.32) provided no components or parts are removed from the unit and no unauthorized adjustments are made to the beam-limiting device or tube housing assembly.
- Never remove or remanufacture any part of the tube head assembly or beam-limiting device unless under the direction of Instrumentarium Dental or their authorized distributor.
- Never adjust any part of the beam-limiting device unless under the direction of Instrumentarium Dental or their authorized distributor.

Disposal

- At the end of the useful working life of the equipment and/or its accessories make sure that you follow national and local regulations regarding the disposal of the equipment, its accessories, parts and materials.
- The equipment includes some or all of the following parts that are made of or include materials that are non-environmentally friendly or hazardous:
 - x-ray tube head (Pb, Be and mineral oil)
 - all electronic circuit boards

Disclaimer


- Instrumentarium Dental shall have no liability for consequential damages, personal injury, loss, damage or expense directly or indirectly arising from the use of its products.
- No agent, distributor or other party is authorized to make any warranty or other liability on behalf of Instrumentarium Dental with respect to its products.

2 Error messages and troubleshooting

2.1 Error messages

The error messages are grouped into two categories: User errors (H) and system fault errors (E). User errors must either be acknowledged or it will be removed once the error is corrected. When system faults occur, a service technician should be contacted.

Code	Error or Failure	Action
E1	KV failure	Check the fuses. Check the cable connections. Check LA1 light on the generator board: ON -> Change the tube head OFF -> Change the generator module.
E2	MA failure	Check the fuses. Check the cable connections. Switch off and on the unit and calibrate it. Change the tube head.
E3	PREH failure	Check the cable connections. Switch off and on the unit and calibrate it. Change the generator module.
E4	Tube head too hot or too cold	Wait for valid tube head temperature
E5	DC voltage out of range	Check the line voltage. Change the generator module.
E6	Sigma link error or sensor not ready	Check Sigma-FOCUS™ interface cable and cable connections
E7	EEPROM failure	1) Reset parameters (kV+D) 2) Change CPU
Necessary waiting time	Duty cycle	Wait for tube to cool
H2 Note: H2 flashes alternately with elapsed exposure time	Premature button release	Acknowledge with UP or DOWN button

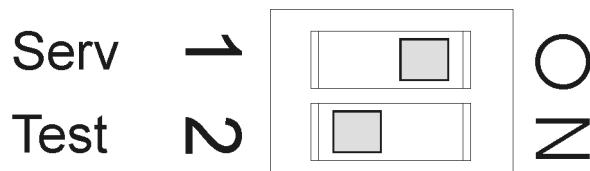
Code	Error or Failure	Action
H3	Door switch error: door open. When a door switch is connected to the connection box.	In case a door switch is in use, close the door to enable exposure. Otherwise check that the dipswitch no.1 is in on-position on the connection box board.
H4	Door switch error: door open. When a door switch is connected to the remote control.	In case a door switch is in use, close the door to enable exposure. Otherwise check that the dipswitch no.2 is in on-position on the remote control board.
H5	System in Service mode	Go to the user mode by pressing two buttons simultaneously (1). 
H6	Current Sigma clocking mode and resolution selection do not support AEC.	Change resolution mode to minimum dose in CliniView. This error message may appear only with CliniView 3.0 or earlier.
H7	Exposure out of range, exposure cancelled. (in AEC mode)	Too much attenuation between the sensor and the tube. Check that tube head and sensor are correctly aligned.

3 Service mode

3.1 FOCUS™ 2.0

3.1.1 Entering the service mode

Set the CPU board's Serv switch to the ON position.



Press the D button on the remote control at least two seconds until "Sr1" appears on the display.



Scroll with the arrow keys until the right service code appears on the display.

3.1.2 Error log, Sr 1

Press kV button to get in Sr1.

You can view last ten error/multification messages by browsing with arrow keys.

3.1.3 Reset error log, Sr 2

Press kV button when "Sr 2" is selected in order to clear error log.

3.1.4 Reset the exposure counter, Sr 3

Each unit has the counter which counts the number of the exposures. The counter should be reset if the tube head has been changed. Enter the service mode.

Scroll with the arrow keys until "Sr3" appears on the display.



Press kV button. The unit beeps twice when the counter is reset.

3.1.5 Show tube type, Sr 4

Scroll with arrow keys until “sr 4” appears on the display. Press kV button to enter the program. Tube type is shown on the screen.

3.1.6 Calibration procedure of the unit

3.1.6.1 Calibration

The unit must be calibrated always after the tube head, CPU board, EPROM microchip or the voltage setting has been changed. By calibration the tube current and preheat are adjusted into the limits.

The calibration is performed with the nominal voltage (115 V or 230 V).



Scroll with the arrow keys until the “Sr5” appears on the display.



Press the kV button once until “Ca1” appears on the display. Unit is ready for tube current (7mA) calibration.



Press the exposure button until the unit beeps twice and “Ca2” appears on the display. You may need to press the exposure button several times until the calibration is succeeded.



Unit is ready for 60kV preheat calibration.



Press the exposure button until the unit beeps twice and “Ca3” appears on the display. You may need to press the exposure button several times until the calibration is succeeded.



Unit is ready for 70 kV preheat calibration.



Press the exposure button until the unit beeps three times and “Sr5” appears on the display. You may need to press the exposure button several times until the calibration is succeeded.



The unit is now calibrated.

3.1.6.2 Calibration of AEC, Sr 6

NOTE! *This service program is used in units from s/n 2141 and in units with FOCUS™ AEC kit installed.*

In this service program you can calibrate AEC. The calibration affects the exposure level that is shown with the image information. The exposure level must be between 80% and 100% for a correctly working AEC and optimum image. If the level is not within the range, you can adjust so called multiplier and offset value to correct the exposure level.

Multiplier is a variable in the exposure time formula of the AEC. Multiplier alternatives are 7/5, 7/4, 2/1, 7/3, 5/2, 3/1, 7/2 and 4/1. Increasing the multiplier raises the exposure level and decreasing of the multiplier lowers the exposure level.

However, in case of small attenuation, for instance a bitewing image of a toothless patient, AEC would produce too low exposure levels (<80%) if only multiplier value was adjusted. Then also the offset value is needed to be set. Offset value is a fixed amount of time that is added to every AEC exposure. Offset alternatives are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 milli-seconds.

Before entering program Sr6, put AEC on and make an exposure of a 10 mm thick Al-plate (or any attenuation that is 10 mm Al equivalent) and another exposure without anything but air between sensor and cone of FOCUS™. Both exposures with AEC, 60 kV and as short distance as possible between the Sigma sensor and cone of FOCUS™. Check the exposure level percentage from the image information of both images. If it is not between 80% and 100% in either image, adjust multiplier and/or offset as follows.

Multiplier



1. Enter the service program mode by setting the service switch to ON position. Scroll with the arrow keys until the "Sr6" appears on the display. Press the kV button to enter the program.. Scroll with the arrow keys until the "Sr6" appears on the display. Press the kV button to enter the program.
2. You can scroll through the multipliers with arrow keys. Choose the multiplier.

3. Enter the user program mode by setting the service switch to OFF position. Select 60 kV, check that AEC is on (led next to AEC button is illuminating) and make an exposure of the Al-plate.
4. Check the exposure level from the image information dialogue.
5. Make another adjustment if necessary (enter the service program mode etc.)

Offset

1. Enter the service program mode by setting the service switch to ON position. Scroll with the arrow keys until the "Sr6" appears on the display. Press the kV button to enter the program which is displayed as fraction.



2. Press the patient button to enter the offset level.
3. Select the offset value by scrolling with arrow keys.
4. Enter the user program mode by setting service switch to OFF position. Select 60 kV, check that AEC is on (led next to AEC button is illuminating) and make exposure without anything but air between the sensor and the cone of FOCUS™.
5. Check the exposure level from the image information dialogue.
6. Make another adjustment if necessary (enter the service program mode etc.).

3.1.7 After the service



1. Exit service program by pressing the D button until the exposure time appears on the display.
2. Set the service and test switches off.
3. Lift the electronics. It is easier to slide the cables back in if you remove the horizontal arm cap near the wall mounting and pull gently the cables by your hand from the end of the arm.

NOTE! Do not pinch the wires between the horizontal arm and the bottom plate while lifting the electronics board.

4. Make one test exposure to make sure that the unit works properly.

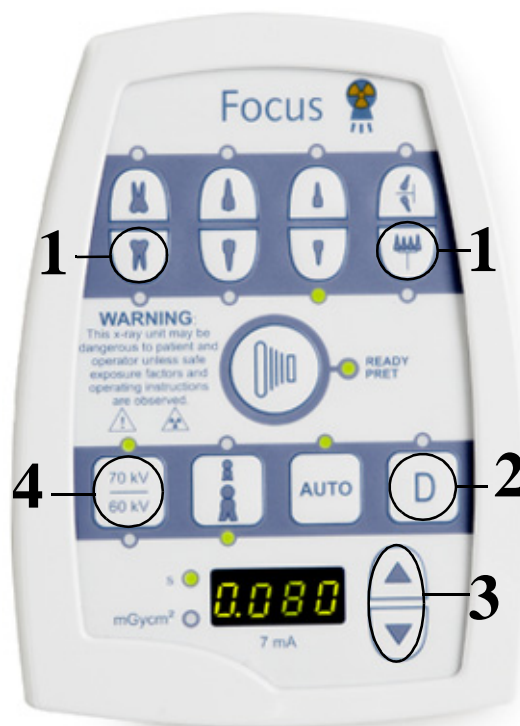
3.2 FOCUS™ 3.0

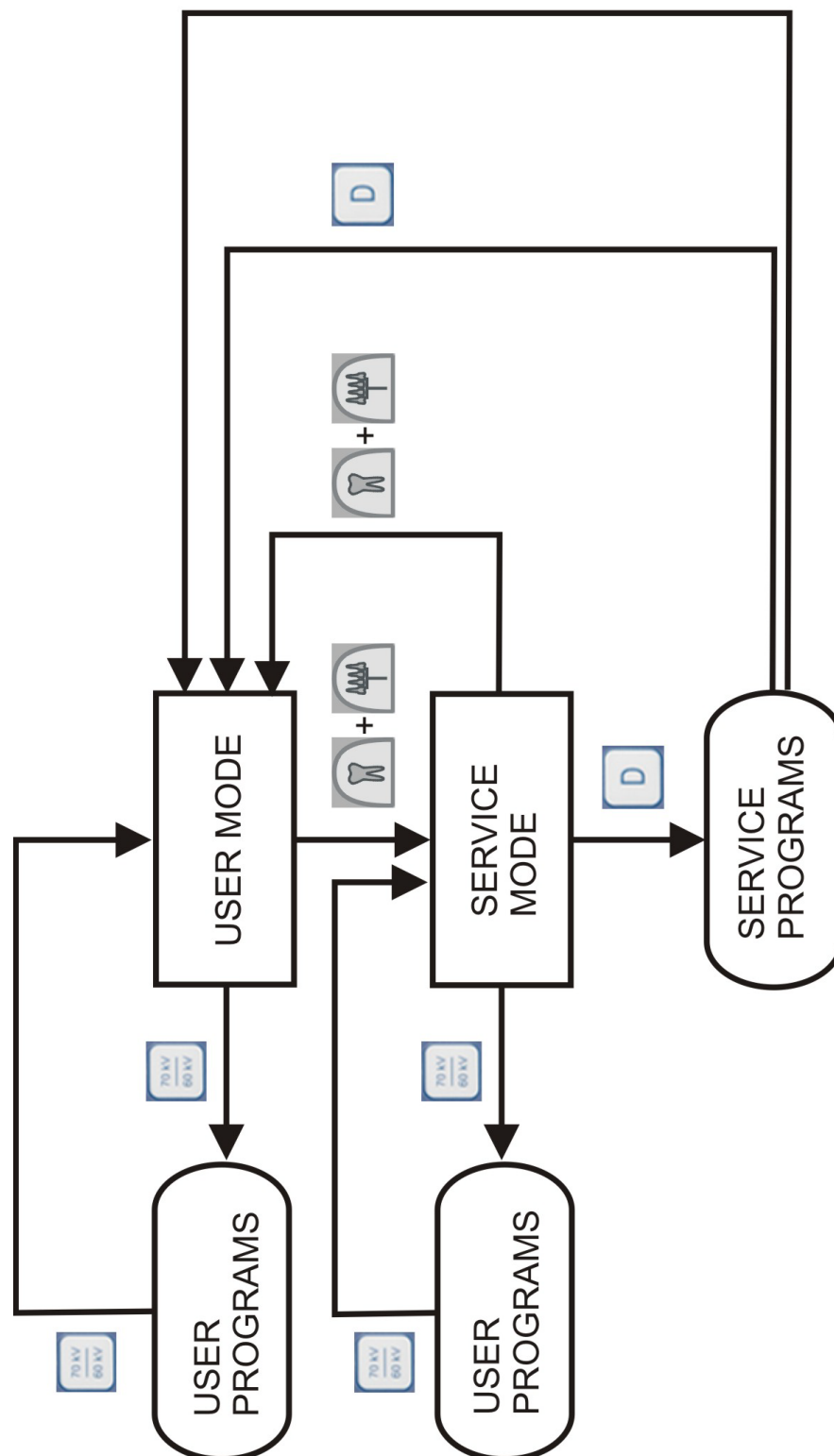
3.2.1 Entering the service programs

1. Switch the power on.
2. Display shows (example):
3.15 (firmware number)
0.063 (Exposure time)
3. To enter service programs press two buttons (no. 1, see picture below) simultaneously.

NOTE! The service mode is indicated by displaying 'Srv', but only momentarily.

4. Press D-button (2) for two seconds to start service programs menu.





3.2.2 Service programs

Scroll with arrow keys (no. 3) until the right service program code appears on the display. Each service program is entered by pressing kV (no. 4). Use kV-button (no. 4) also to exit each service program and to save changed settings. To exit service mode press D-button (no. 2) for 2 seconds. Three beep-sounds confirm the return to the normal mode.

1. Error log, Sr 1

Press kV button to get in Sr1. You can view last ten error/notification messages by browsing with arrow keys.

2. Reset error log, Sr 2

Press kV button when Sr 2 is selected in order to clear error log.

3. Reset the exposure counter, Sr 3

Press kV button to reset the exposure counter when the tube head has been changed. The unit beeps twice when the counter is reseted.

4. Show tube type, Sr 4

Tube type is shown on the screen.
TOS = Toshiba.

5. Calibration procedure of the unit, Sr 5

This is not needed in FOCUS™ R3.0 (starting from s/n 8000). The unit calibrates itself automatically after every exposure. Calibrate the unit by exposing manually 60 kV, 1.00 s exposures 8 times. This calibrates filament preheat and tube current.

6. Calibration of AEC (Automatic Exposure Control), Sr 6

This program calibrates AEC. The calibration affects the exposure level that is shown with the image information in CliniView. The exposure level must be between 80% and 100% for a correctly working AEC and optimum image, otherwise you should adjust so called multiplier and offset value to correct the exposure level. Multiplier is a variable in the exposure time formula of the AEC. Multiplier alternatives are 7/5, 7/4, 2/1, 7/3, 5/2, 3/1, 7/2 and 4/1.

Increasing the multiplier raises and decreasing lowers the exposure level. However, in case of small attenuation, for instance a bitewing image of a toothless patient, AEC would produce too low exposure levels (<80%) if only multiplier value was adjusted. Then also the offset value is needed to be set. Offset value is a fixed amount of time that is added to every AEC exposure. Offset alternatives are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 milli-seconds.

Before entering Sr6, put AEC on and make an exposure of a 10 mm thick Al-plate (or any attenuation that is 10 mm Al equivalent) and another exposure without anything but air between sensor and cone of FOCUS™. Both exposures with AEC, 60 kV and as short distance as possible between the Sigma sensor and cone of FOCUS™. Check the exposure level percentage from the image information of both images. If it is not between 80% and 100% in either image, adjust multiplier and/or offset as follows.

Multiplier

1. Enter the service program mode. Scroll with the arrow keys until the "Sr6" appears on the display. Press the kV button to enter the program, which is displayed as fraction.
2. You can scroll through the multipliers with arrow keys. Choose the multiplier.
3. Enter the user program mode. Select 60 kV, check that AEC is on (led next to AUTO button is illuminating) and make an exposure of the Al-plate.
4. Check the exposure level from the image information dialogue.
5. Make another adjustment if necessary (enter the service program mode etc.)

Offset

1. Enter the service program mode. Scroll with the arrow keys until the **Sr6** appears on the display. Press the kV button to enter the program which is displayed as fraction.
2. Press the patient button to enter the offset level.
3. Select the offset value by scrolling with arrow keys.
4. Enter the user program mode. Select 60 kV, check that AEC is on (led next to **AUTO** button is illuminating) and make exposure without anything but air between the sensor and the cone of FOCUS™.
5. Check the exposure level from the image information dialogue.
6. Make another adjustment if necessary (enter the service program mode etc.).
7. **PC serial link, Sr 7**
on (default) enables software upgrade via cable.
off.
8. **Show mode, Sr 8**
 With this program x-rays can be turned off e.g. in exhibitions.
d on = Demo mode on. No radiation.
d off = Demo mode off.
 Return the unit once on after setting the show mode. Cycle the power from power switch or press reset button on CPU board after setting the demo mode on/off. Successfully activated demo mode is indicated on the remote control panel on system start up. "deOn" is shown on the display briefly during the startup.

TOTAL RESET (of EEPROM)

Sw 3.03 or newer: Press kV, UP arrow and D button simultaneously in case of malfunction.

Sw 3.01 - 3.02: Press kV and D button simultaneously in case of malfunction.

Turn the power off from the main switch (make sure that the display is blank) or press the reset button on the CPU board to complete the total reset -procedure. Factory defaults are taken into use. Calibrate the unit by exposing manually 60 kV, 1.00 s exposures 8 times.

NOTE! *This resets all parameters in FOCUS™. Do not use unnecessarily!*

4 Upgrading the firmware

4.1 FOCUS™ 2.0

Upgrading the software for FOCUS™ 2.0 is performed by replacing the memory chip with the firmware. Memory chips are available as a spare part.

Compatibility Table

	CPU 1.0	Rem. 1.0	Rem. 1.2	Rem. (AEC) 1.4	Conn. 1.0	Conn. (AEC) 1.0	Gen. 1.0	Gen. 2.1
SW 1.0	X	X	X	X	X	X		X
SW 1.01	X	X	X	X	X	X		X
SW 1.02	X	X	X	X	X	X	X	X
SW 1.03	X	X	X	X	X	X	X	X
SW 2.20	X	X	X	X	X	X	X	X

Table 4.1 Rem. = Remote Control, Conn. = Connection Box board, Gen. = Generator board

- 1. Removing the old chip**
Switch off the unit and open the electronics. Remove carefully the EPROM chip from the CPU board. Use the specific chip extractor (the example below by OK Industries).
In case no suitable tool is available remove the chip by rocking it little by little with the flat screwdriver from both ends.
- 2. Placing the new one**
Place the new EPROM carefully on the CPU board. Take care that all pins of the chip fit the base. If the pins are too wide to fit bend the pins carefully.
- 3. Restore the factory settings**
Restore the factory settings by switching 'TEST' dip on and turning FOCUS™ on and then switch 'TEST' dip off.
- 4. Calibrating the unit**
Set the CPU board's Serv switch to the ON position and make sure that the Test switch is in the OFF position.

Press the D button on the remote control at least two seconds until "Sr1" appears on the display.

Scroll with the arrow keys until the "Sr5" appears on

the display.

Press the kV button until “Ca1” appears on the display. This calibrates mA value.

Press the exposure button until the unit beeps twice and “Ca2” appears on the display. “Ca2” calibrates preheat (60 kV). Repeat if not successful.

Press the exposure button until the unit beeps twice and “Ca3” appears on the display. “Ca3” calibrates preheat (70 kV). Repeat if not successful.

Press the exposure button until the unit beeps three times and “Sr5” appears on the display. The unit is now calibrated.

Press D button at least two seconds until the exposure time appears on the display.

Turn off the unit and set the serv switch off.

Finally lift the electronics back and tighten the screws.

NOTE! *Do not pinch the wires between the horizontal arm and the bottom plate while lifting the electronics board.*

4.2 FOCUS™ 3.0

Firmware for the FOCUS™ 3.0 is delivered together with a PC application that uploads the firmware to the FOCUS™ unit through a serial connection.

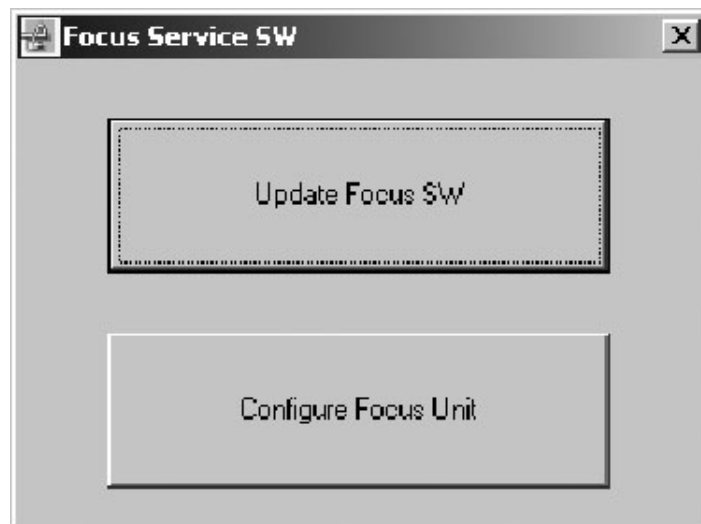
Contact Instrumentarium Dental technical support for the latest firmware package as when an upgrade is needed.

Compatibility Table

	CPU 1.0	Control Panel 1.1	Control Panel 1.2	Control Panel 2.0	Genera- tor Rev. 1	Genera- tor Rev. 2	Genera- tor Rev 3.	Tube head 1.0	Tube head 1.1
SW 3.00	X	X	X	X	X	X		X	X
SW 3.01	X	X	X	X	X	X		X	X
SW 3.02	X	X	X	X	X	X	X	X	X
SW 3.03	X	X	X	X	X	X	X	X	X
SW 3.10	X	X	X	X	X	X	X	X	X
SW 3.11	X	X	X	X	X	X	X	X	X

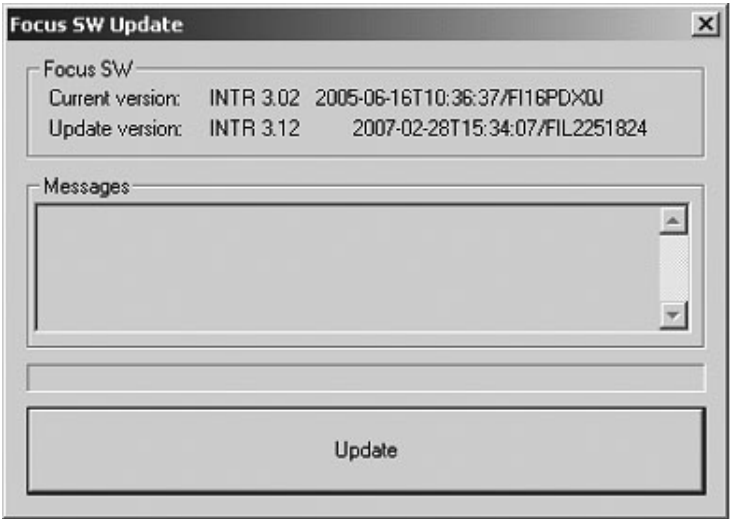
	CPU 1.0	Control Panel 1.1	Control Panel 1.2	Control Panel 2.0	Genera tor Rev. 1	Genera tor Rev. 2	Genera tor Rev 3.	Tube head 1.0	Tube head 1.1
SW 3.12	X	X	X	X	X	X	X	X	X
SW 3.13	X	X	X	X	X	X	X	X	X
SW 3.14	X	X	X	X	X	X	X	X	X
SW 3.15	X	X	X	X	X	X	X	X	X
SW 3.16	X	X	X	X	X	X	X	X	X

1. Copy the FOCUS™ service software to a computer with a serial port.
2. Connect the PC to the FOCUS™ service connector with a null-modem cable.
3. Launch the FOCUS™ service software application click the **Update Focus SW** button.



4. Verify that the service software is ready to upload the correct firmware version and click **Update**. Follow the instructions of the software.

NOTE! The Update version for this SW is INTR 3.16.



5 Changing the generator board

5.1 FOCUS™ 2.0

CAUTION! *Assure that the unit is switched off and disconnected from mains prior to changing the electronics.*

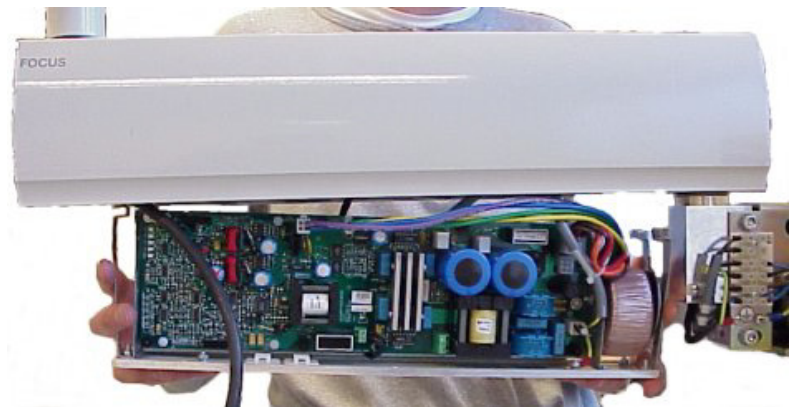
Disconnect the cables F20, F5, F19, F25, GND, F14, F18, F24, F9, F16, F23, F26, F27, F28 and all cables to the transformer.

5.1.1 Old units, before s/n F1243

Remove the cable, which comes from the scissors arm by opening the connectors X50 and X48 and disconnecting the ground cable.

5.1.2 Later units, after s/n F1243

1. Disconnect the cables under the horizontal arm's cap.
2. Remove the cable from the horizontal arm bracket by opening the connectors X42 and X47 and disconnecting the ground cable.
3. Hold the electronics and press the hangers. The electronics will come off.



4. Loosen the screws that are holding the board and replace the generator board.
5. Remove four nuts holding the CPU board and remove the CPU board carefully.
6. To install the electronics back proceed as stated above in reverse order. Remember to secure the cable that comes from the scissors arm with a cable tie.
7. Before supplying the power to the unit, check the voltage settings:

Connector

X45 (Upper)	230 VAC
X46 (Lower)	115 VAC

External fuses

5A (slow blow)	230 VAC
8A (slow blow)	115 VAC

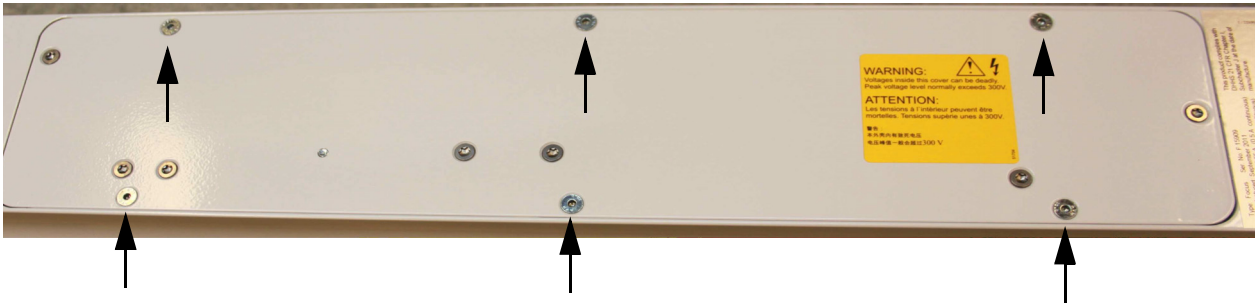
Internal fuses

1A	230 VAC
1.6A	115 VAC

5.2 FOCUS™ 3.0

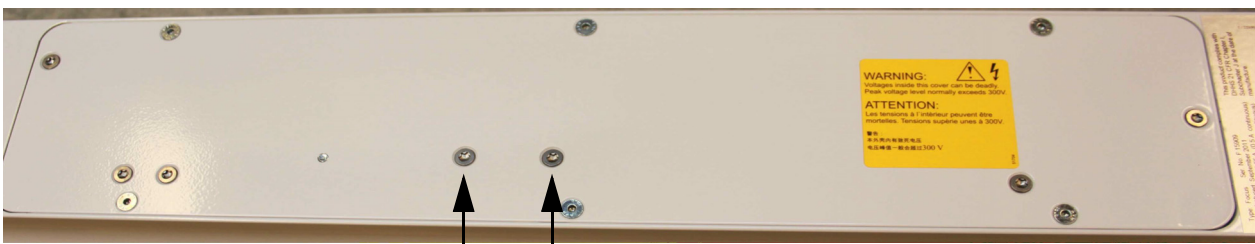
CAUTION! *Assure that the unit is switched off and disconnected from mains prior to changing the electronics.*

1. Open 6 screws and carefully lower the bottom plate of the horizontal arm, leaving it hang from the hangers.



2. Disconnect the cables from connectors X31,X32,X37 X42,X47,X48,X50,X53, X54, two ground cables and all cables from the filter.

Loose also 2 screws from bottom which hold the metal cable holder in the middle.



3. Hold the electronics and press the hangers. The electronics will come off.



- 4.** Squeeze plastic holders to remove the CPU board carefully.
- 5.** Loosen the 6 screws that are holding the board and replace the generator board.
- 6.** To install the electronics back proceed as stated above in reverse order.

6 Changing the horizontal arm

CAUTION! *Assure that the unit is switched off and disconnected from mains prior to changing the electronics.*

6.1 Removing the arm

1. Set the FOCUS™ in such position that the articulated arm is completely folded up. Bind the arms together with a strap.
2. Remove horizontal arm plugs at the both ends. Remove the friction brakes.
3. Remove the electronics as per the chapter Changing the generator board.
4. Lift up the articulated arm from top of the horizontal arm and assure that the cables can follow freely.
5. The arms must be lifted carefully direct upwards because of the close fit of the shafts.
6. Detach the covers of the connection box. Undo the couplings between the connection box and the horizontal arm. Lift up the horizontal arm.
7. Remove the adjustable brakes from both ends of the horizontal arm.

6.2 Attaching the arm

1. The new horizontal arm profile incorporates the shaft and bearings.
2. Lift the horizontal arm to its place and attach the nuts. Note that there are two nuts on each side of the wall mounting bracket. Leave the nuts slack to allow for leveling.
3. Route the cables from the connection box through the shaft of the new horizontal arm.
4. Install the electronics back in position and make the couplings.
5. Adjust the wall mounting arm bracket by means of a level (there is $\pm 2^\circ$ adjustment allowance).
6. Repeat the assembly of the unit according to the Unit Installation Manual.

6.3 Leveling the arm

- 1.** Loosen the nuts on both sides of the horizontal arm bracket.
- 2.** Locate the adjuster screw in the adjustment plate below the shaft. Rotate the adjuster screw observing at the same time the level on the horizontal arm.
- 3.** Perform the adjustment until the arm is horizontal.
- 4.** Tighten the four lock screws on the side of the wall mounting bracket to assure that the horizontal arm stays in position.
- 5.** After adjusting the horizontal arm, cut off the safety strap to release the scissors arm.

7 Changing the tube head

The change of the tube head differ some depending on tube heads version.

Instructions for tube head versions:

- 3.0 are in chapter 7.2
- 1.6 and 2.0 are in chapter 7.1.1
- 1.3 to 1.5 are in chapter 7.1.2

The version number is shown on the cover of the tube head.

7.1 FOCUS™ 2.0

7.1.1 Changing the tube head (v1.6 and 2.0)

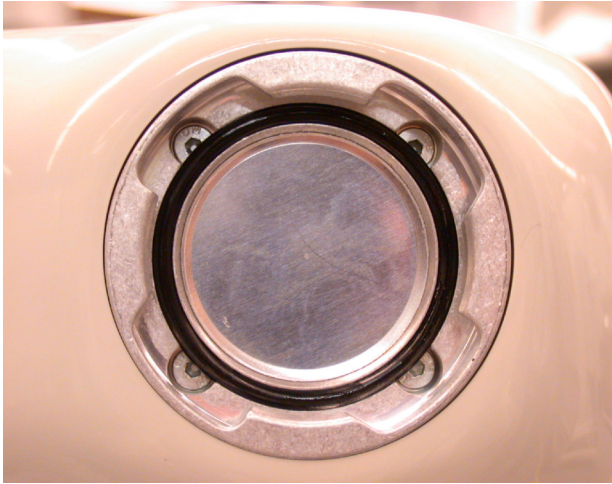
Tube head version 1.6 can be replaced with version 1.6 and version 2.0 or higher can be replaced with version 2.0 or higher.

NOTE! *Version 2.0 does not fit to units with tube head versions 1.3 to 1.6 because of the difference between main cables. Tube head version 2.0 with new scissor arm (main cable) does not fit with old horizontal arm with generator board version 1.2.*

1. Switch off the unit and disconnect from the main.
2. Release the angle ring with a screwdriver (size 1.2x6.5x125) and remove the back cover.



3. Remove the O-ring and the aluminum filter.



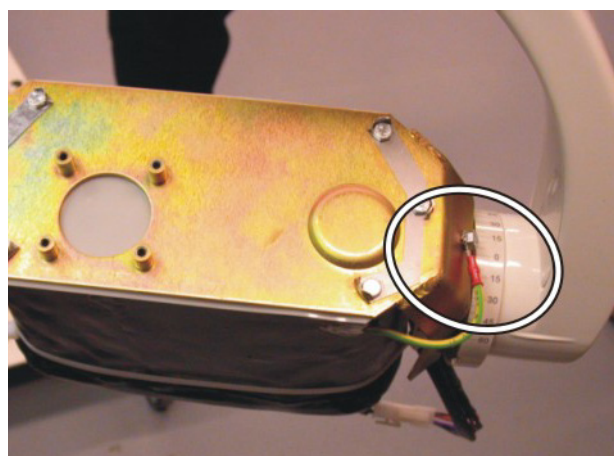
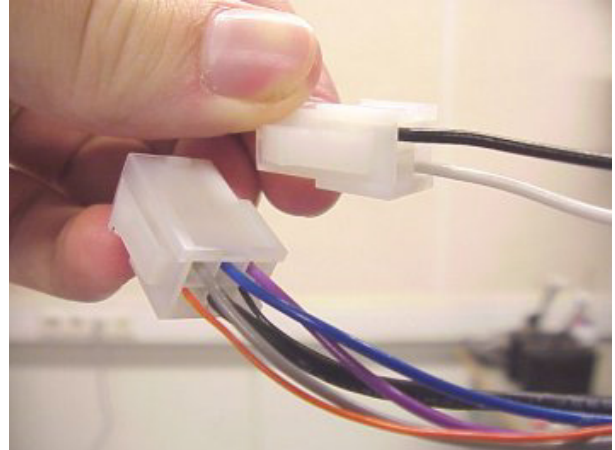
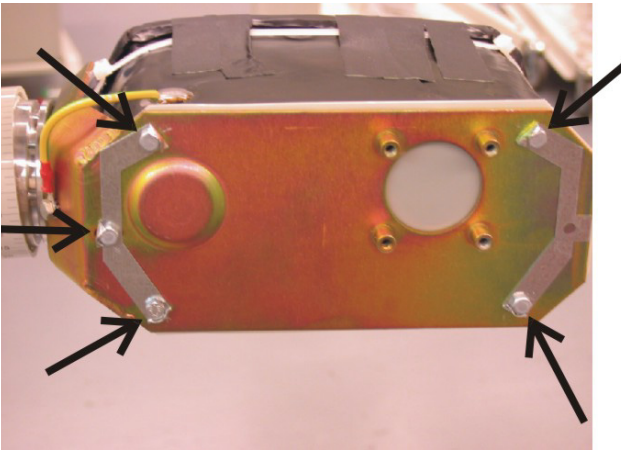
- 4.** Remove the tube heads front cover, cable tie and tapes.



- 5.** Detach the Molex connectors and ground cable from tube head. Disengage the bottom screws from the locking plates and remove the screws.
- 6.** Replace the tube head with new one. Remember to put the mylar coat between the bracket and the tube head. Set the locking plates on the bottom of the bracket and tighten the screws with 0.5 Nm torque. Use torque wrench. Do not use any glues. Fix the locking plates around the bottom screws.

CAUTION!

Excessive tightening may damage the tube head.



- 7.** Connect the molex connectors and screw down the ground cable. Screw down the ground cable to the tube head bracket.
- 8.** Bind the cables around the tube head with cable clamp and tape.
- 9.** Attach the front cover and aluminum filter to the tube head. Set the O-ring in to the filter.



- 10.** Put the back cover back in place.



- 11.** Fasten the angle ring so that the nodules of the angle ring will meet the hole in the cover. Turn the ring step by step and wedge it with a screwdriver.



CAUTION! After installation, calibrate the unit.
See chapter Calibration procedure of the unit.

7.1.2 Upgrading the tube head (V1.3-1.5) to 1.6

- 1.** Switch off the unit and disconnect from the main.
- 2.** Remove the angle ring. Be careful not to scratch the covers.



- 3.** Remove the back cover of the tube head.



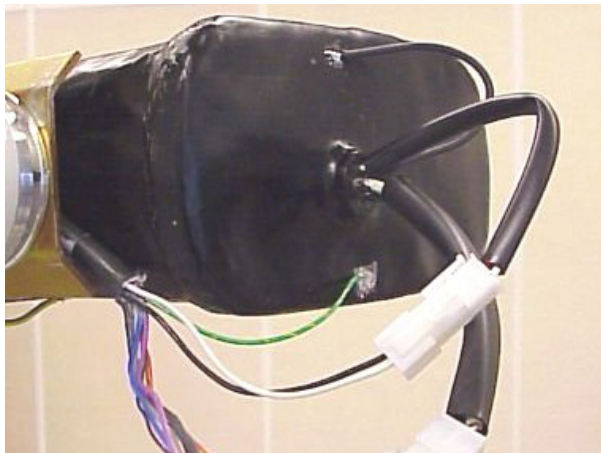
- 4.** Remove the O-ring and the aluminum filter.



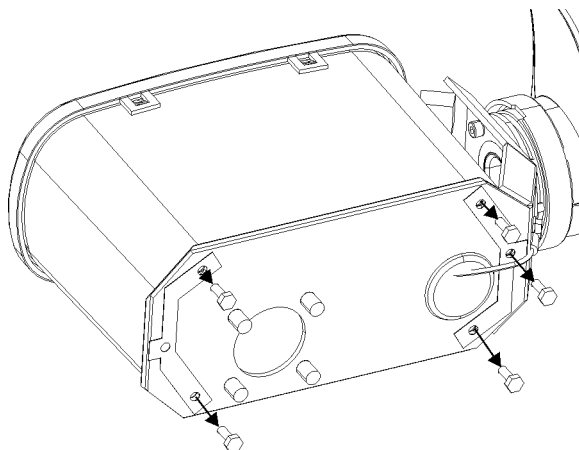
- 5.** Remove the tube heads front cover, tapes and the cable tie.



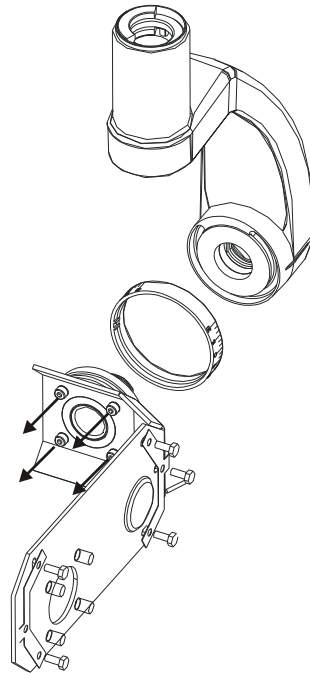
- 6.** Cut the ground cable from the side of the soldered joint and unscrew the other ground cable from the tube head. Detach the Molex cable connectors.



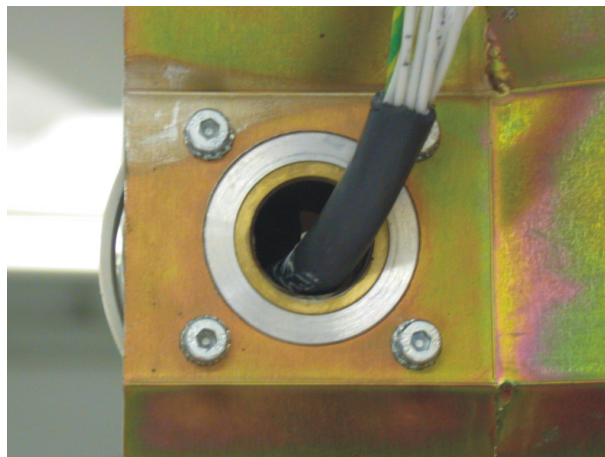
- 7.** Remove the screws and locking plates from the bottom of the bracket and remove the tube head.



- 8.** Remove the four screws from the base of the bracket. Remove the bracket. Set a new angle ring between the handle and the bracket.



- 9.** Place the main cable back to go through the bracket base hole and install the tube head bracket to the handle.

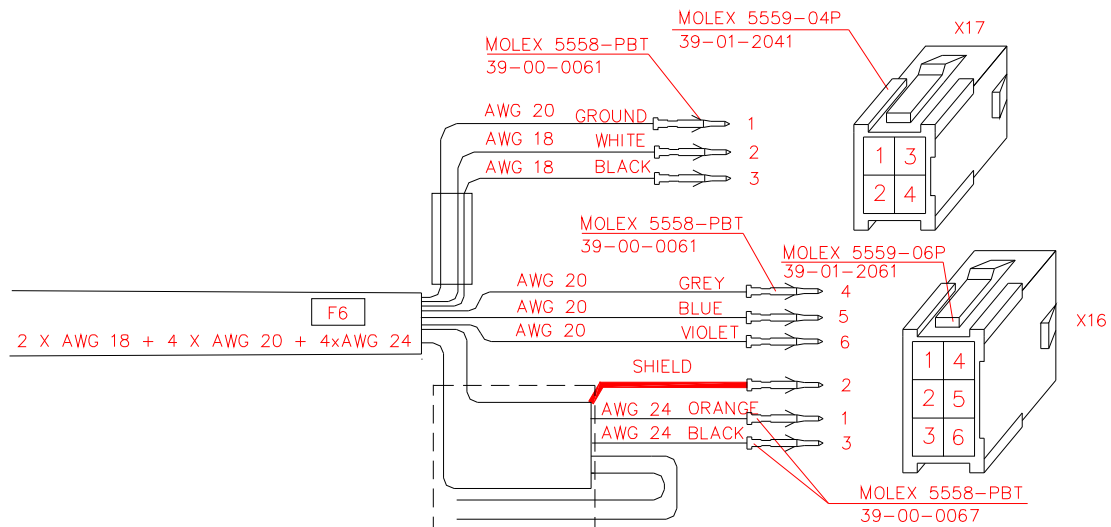


- 10.** Insert the new tube head in to the bracket and remember to set the mylar coat between the tube head and the bracket. Set the locking plates on the bottom of the bracket and tighten the screws with 0.5Nm torque. Use torque wrench. Do not use any glues. Fix the locking plates around the bottom screws.

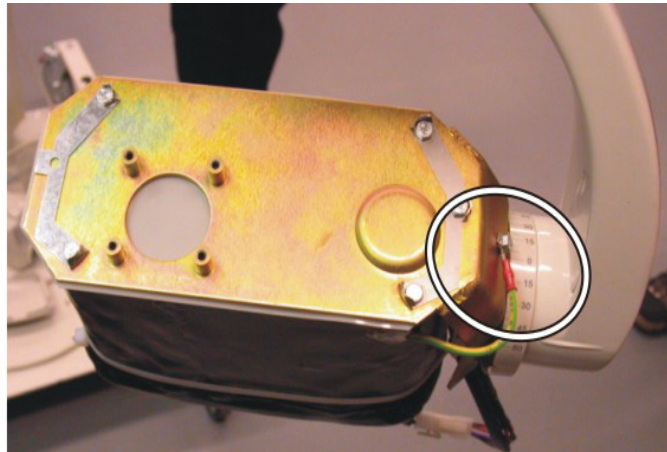
Excessive tightening or using glue may damage the tube head.

NOTE! If the removed tube head version was 1.3 or 1.4 the mylar coat has come with the spare part package.

- 11.** Connect a Molex pin to the ground wire of the main cable with special pincers and connect the ground wire to Molex connector according to the diagram below.



- 12.** Check after connecting the X17 connector into it's counterpart that GND wire pins matches.



- 13.** Attach the front cover and aluminum filter to the tube head. Set the O-ring in the filter.



- 14.** Put the back cover back in place.



- 15.** Fasten the scale ring so that the nodules of the scale ring will meet the hole in the cover. Turn the ring step by step and wedge it with a screwdriver.



CAUTION! After installation, calibrate the unit. Refer to chapter Calibration procedure of the unit.

7.1.3 Reset the exposure counter, Sr 3

Each unit has the counter which counts the number of the exposures. The counter should be reset if the tube head has been changed. Enter the service mode.

Scroll with the arrow keys until “Sr3” appears on the display.

Press kV button to reset the exposure counter when the tube head has been changed. The unit beeps twice when the counter is reseted.

7.2 FOCUS™ 3.0 (tubehead v3.0)

1. Switch off the unit and disconnect from the main.
2. Release the angle ring with a screwdriver and remove the back cover.



3. Remove the O-ring and the aluminum filter.



4. Remove the tube heads front cover, cable tie and tapes.

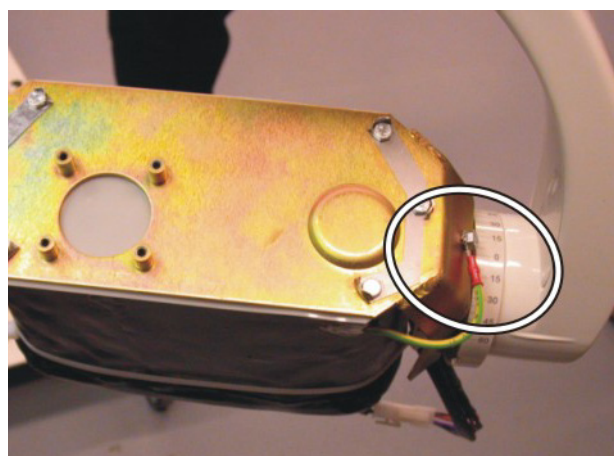
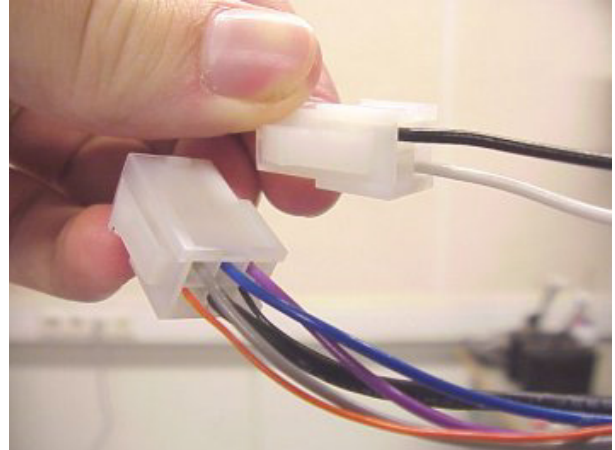
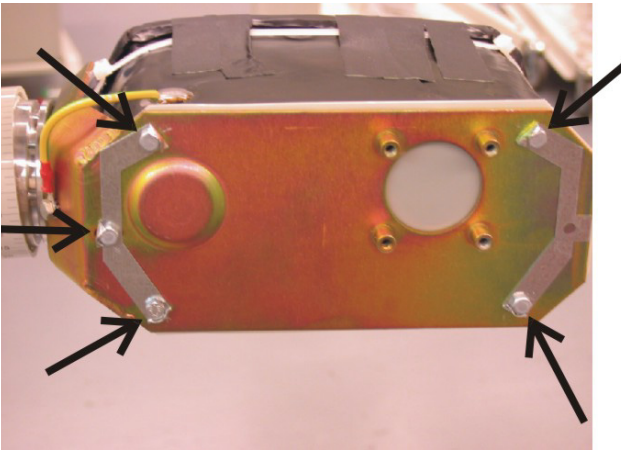


5. Detach the Molex connectors and ground cable from tube head. Disengage the bottom screws from the locking plates and remove the screws.
6. Replace the tube head with new one. Remember to put the mylar coat between the bracket and the tube head. Set the locking plates on the bottom of the bracket and tighten the screws with 0.5 Nm torque. Use torque wrench. If the torque wrench is not available use the similar tool like in the picture, and tight the screws using only two fingers. Do not use any glues. Fix the locking plates around the bottom screws.



CAUTION!

Excessive tightening may damage the tube head.



- 7.** Connect the molex connectors and screw down the ground cable. Screw down the ground cable to the tube head bracket.
- 8.** Bind the cables around the tube head with cable clamp and tape.
- 9.** Attach the front cover and aluminum filter to the tube head. Set the O-ring in to the filter.



- 10.** Put the back cover back in place.



- 11.** Fasten the angle ring so that the nodules of the angle ring will meet the hole in the cover. Turn the ring step by step and wedge it with a screwdriver.



NOTE! After installation, calibrate the unit.
See chapter Calibration procedure of the unit.

7.2.1 Reset the exposure counter, Sr 3

Each unit has the counter which counts the number of the exposures. The counter should be reset if the tube head has been changed. Enter the service mode.

Scroll with the arrow keys until “Sr3” appears on the display.

Press kV button to reset the exposure counter when the tube head has been changed. The unit beeps twice when the counter is reseted.

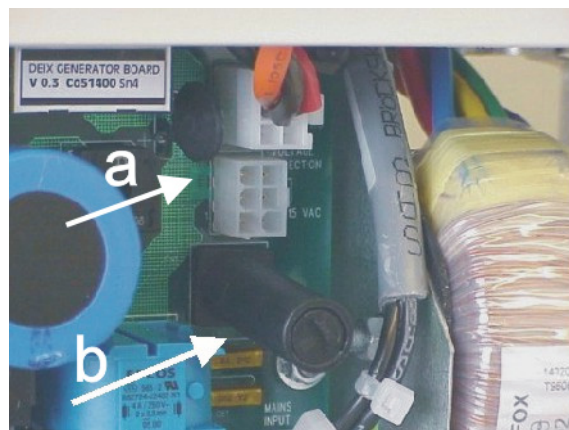
8 Changing the voltage

8.1 FOCUS™ 2.0

Remove the main voltage selection plug (a) and move it to correct position.

Connector

X45 (Upper)	230 VAC
X46 (Lower)	115 VAC



After changing the voltage selection plug change the internal fuse (b) and external fuses (c) as per following instructions:

- Push on the fuse base and twist it counter-clockwise with a screwdriver. The fuse with the base will come out.
- Remove the fuse from the base and replace it with the new one. Repeat this with each fuse.
- Fasten the fuses by pushing the base up and twisting it clockwise with a screwdriver.
- Use only appropriate fuses.

External fuses

5A (slow blow)	230 VAC
8A (slow blow)	115 VAC

Internal fuses

1A	230 VAC
1.6A	115 VAC

8.1.1 Changing of the external fuses

Push upward on the fuse base and twist it counter-clockwise with a screwdriver. The fuse with the base will come out.

Remove the fuse from the base and replace it with the new one. Repeat this with each fuse.

Fasten the fuses by pushing the base up and twisting it clockwise with the screwdriver.

Use only appropriate fuses.

External fuses

6,25 A (slow blow)	230 VAC
6,25 A (slow blow)	115 VAC

8.2 FOCUS™ 3.0

FOCUS™ 3.0 has an universal power supply that is readily functional with all specified operating voltages between 110V – 240V.

The mains fuse is 6,25 A slow blow for mains voltages.

8.2.1 Mains voltage:

Verify the main voltage (3 wire: single-phase, 115V or 230V with protective ground).

Voltage	Voltage range
230 VAC line	207 - 253 VAC
115 VAC line	103-126 VAC

Voltage	Fuse
230 VAC line	6,25 A Slow blow
115 VAC line	6,25 A Slow blow

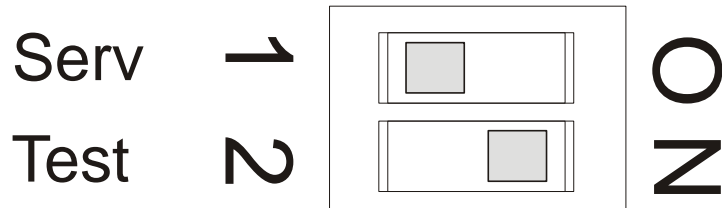
NOTE! *Some countries and/or localities may have regulations on fault current protection. Such regulations must be observed.*

9 Setting the show mode

9.1 FOCUS™ 2.0

The unit can be set on show mode which disables the exposure. Otherwise the unit operates normally.

To set the show mode on switch off the unit and open the electronics. Switch the TEST dip switch on.



- On the generator board put on the jumper J1.
- Disconnect the cables from the connectors X44 and X48. Insulate the wire ends with tape.
- Close the electronics.

To change the unit back into the operating mode perform this chapter in reversed order.

CAUTION!

Calibrate FOCUS™ when put back in exposure mode.

9.2 FOCUS™ 3.0

The unit can be set on show mode with service program SR 8, which disables the exposure. Otherwise the unit operates normally.

Show mode, Sr 8

d on = Demo mode on. No radiation.

d off = Demo mode off.

1. Return the unit once on after setting the show mode.
2. Cycle the power from power switch or press reset button on CPU board after setting the demo mode on/off.
3. Successfully activated demo mode is indicated on the remote control panel on system start up.
4. "deOn" is shown on the display briefly during the startup.

10 After the service

NOTE! *Collect all tools and test material from site.*

10.1 FOCUS™ 2.0

1. Exit service program by pressing the D button until the exposure time appears on the display.
2. Set the service and test switches off.
3. Lift the electronics. It is easier to slide the cables back in if you remove the horizontal arm cap near the wall mounting and pull gently the cables by your hand from the end of the arm.

NOTE! *Do not pinch the wires between the horizontal arm and the bottom plate while lifting the electronics board.*

10.2 FOCUS™ 3.0

1. Exit service program by pressing the D button until the exposure time appears on the display.
2. Power off the unit.
3. Lift the electronics. It is easier to slide the cables back in if you remove the horizontal arm cap near the wall mounting and pull gently the cables by your hand from the end of the arm.

NOTE! *Do not pinch the wires between the horizontal arm and the bottom plate while lifting the electronics board.*

